WORLDWIDE OCEAN OPTICS DATABASE (WOOD)

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LONG-TERM GOAL

The long-term goal is to provide a comprehensive worldwide optics database that includes data on a broad range of important optical properties, including diffuse attenuation, beam attenuation, scattering, and bioluminescence. The database must be easy to use, internet accessible, and frequently updated with data from recent at-sea measurements. The database should serve a wide range of applications, such as environmental assessments, sea test planning, tactical utility assessments, and Navy mission planning. Eventually it should include worldwide coverage from remote sensing datasets, such as CZCS and SeaWIFS, and climatology data products (such as those developed by Longhurst, 1995) that combine remote sensing and *in situ* data.

SCIENTIFIC OBJECTIVES

Many investigations of optical characteristics require supporting data such as profiles of nutrients, temperature, salinity, and water depth. Using the WOOD, one should be able to obtain combined datasets of optical properties and supporting data in order to answer questions about the controlling mechanisms for the observed optical conditions. Data from WOOD will also support the generation of regionally-specific empirical fits that capture the monthly or seasonal optical characteristics of particular locations of high naval interest.

APPROACH

Oracle Version 7.3.3 database software was selected to store all metadata and optics-related data. The Oracle Webserver software Version 2.1 was selected to connect the database to the internet, and the entire system was installed on a Pentium PC running under the Windows NT Server operating system. Table 1 summarizes the metadata included with each data station or profile. (Before settling on this set of parameters, the ocean optics community was surveyed to see what metadata were considered to be essential to optimize the utility of the optics data. Meetings were also held with NOAA and NAVOCEANO to discuss the database design and to finalize its key components.)

Table 1. WOOD Data Descriptors

Julian Date (0-366) *Time* (0000-2359) *Time Type:* 1 = GMT, 2 = Local, 0 = unknown *Latitude /Longitude* *Originating Agency/University* *Dissemination Flag* *Data Type* (1=depth profile, 2=time series, 3=space series) *Units* for delta between data points	*Ocean Bottom Depth* (in meters) *Parameter Recorded* *Instrument Type* *Center Wavelength* (in nm) *Bandwidth* (FWHM in nm) *Angle* (theta in degrees, 0 if not applicable) *Data Resolution*

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WORK COMPLETED

The Oracle database was successfully installed and connected to the internet. Figure 1 shows the Homepage screen accessible at *http://wood.jhuapl.edu*. The database has been registered with several major organizations (including NASA) and its availability has been publicized via direct e-mail, internet user group messages, etc. In addition, all of the Bedford Institute of Oceanography pigment datasets were acquired and entered into the database. Other major contributions were acquired from NOAA and from NRL. Table 2 summarizes the complete list of original sources for data incorporated to date. Figure 2 shows one of the displays available from the Data Locations Menu on the Homepage. These kinds of maps are designed to give users immediate information as to the availability of data by season and location.

Figure 1. WOOD Homepage.

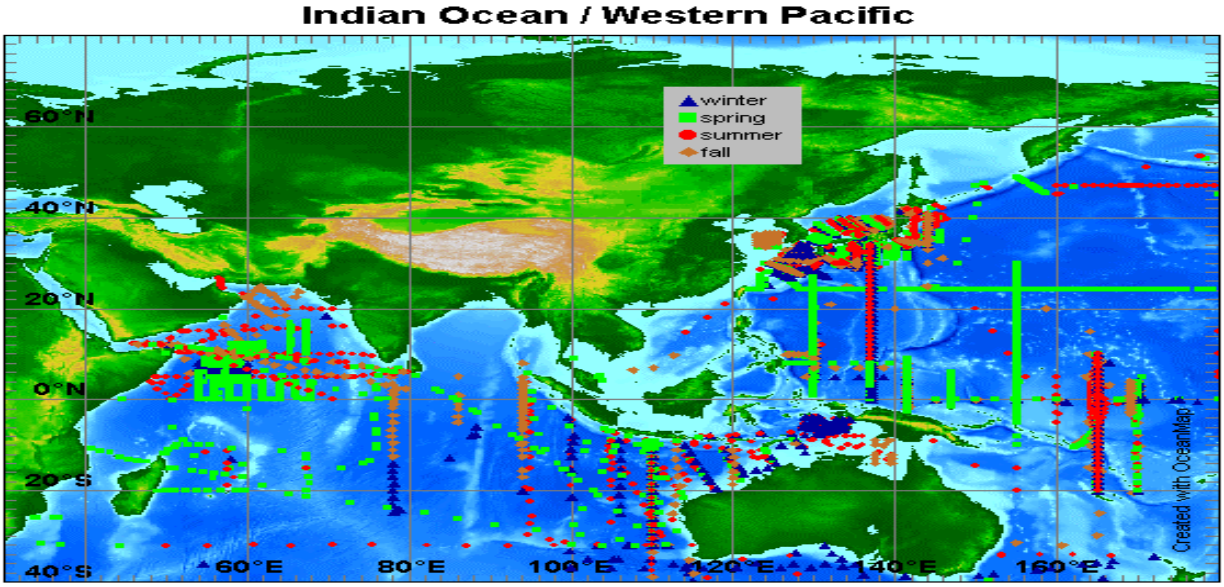

Figure 2. Map of WOOD Data Locations for Indian Ocean & Western Pacific Ocean

Table 2. Author / Original Data Source

Code #	Author / Source	Code #	Author / Source
1	JHU/APL Jeff Smart	36	F. Mantoura
2	JHU/APL Dan Ondercin	37	D. Clark/Jim Firestone
3	CSS Beth Larsen	38	Chavez/Jim Firestone
4	Bedford Inst. Ocean Rept/T.Platt	39	Balch/ Jim Firestone
5	HJ Hirche	40	Biggs/Jim Firestone
6	K Jancke	41	Indian Ocean Data Rpt (1974)
7	F. Rey	42	D. Mackey
8	J. Aristegui	43	T. Hayward; Scripps
9	H.J. Minas	44	Earl Doe
10	Barney Balch	45	K. Furuya; Japan;
11	Cruzado	46	Ocean Research Institute; Tokyo
12	D. Barber	47	ORSTOM/Noumea data report
13	Finenko	48	M. Baars
14	D. Repeta	49	Cambridge; J. Priddle diskette
15	M. Velduis	50	Univ. of Washington; Seattle
16	R. Lowry	51	R. Sambrotto N.Y.
17	Podewski	52	E. Venrick (Scripps)
18	H. Dooley	53	G. Knauer and D.Redalje
19	R. Williams	54	E. Laws
20	J.E. O'Reilly	55	Univ. of Tokyo
21	J. Marra	56	Dr. T. Sugimoto Univ. of Tokyo
22	E. Collins	57	Hattori
23	A.F. Michaels	58	NODC CUEA; Peru-Chile
24	R. Bidigare	59	ALIZE-ORSTOM/Noumea
25	F. Muller-Karger	60	Barber and Chavez (1991)
26	A. Herbland	61	Paul Fiedler et al (1992 DSR)
27	NODC Primary Pigment files	62	C.S.Wong et al (1993); IOS;BC
28	NAVOCEANO/Kim Davis	63	Paul Smith
29	Oceanographic Atlas of Korean W	64	C. A. Chen (Taiwan)
30	NADC, Jack Gibbons	65	H. Hattori/M. Fukuchi/Matsuda
31	NODC Files, M. Conkwright	66	JODC from MEDS;DFO;Ottawa
32	Jim Firestone	67	WHOI RV Knorr data
33	Vodyanitsk/Jim Firestone	68	John Brock/Balch
34	Sayed El-Sayed (Texas A&M)	69	Joe Rhea (NRL/DC)
35	C. Yentsch	70	Ajit Subramaniam (CSC /Charleston, S

Each optical parameter (e.g. the diffuse attenuation coefficient,"K_d", backscatter, " β attenuation coefficient, "**c**") is stored in a separate database table that make up the database system. The user can choose what data to retrieve from WOOD by selecting desired optical parameters, desired wavelength, and range for latitude/longitude, year, julian date, and water depth. The user has the option to receive the complete set of metadata listed in Table 1 or a "Standard" set which includes only the most essential data parameters. Multiple parameters can be retrieved simultaneously. In short, the complete database is readily accessible and easy to search.

RESULTS

Numerous investigators from around the world have already made use of the WOOD, and about a dozen scientists have asked to be included in a session on Optics Databases at the Fall 1998 SPIE Ocean Optics conference. The US Navy has made considerable use of the database to plan upcoming optics-related field exercises and to make vulnerability assessments for potential optics-related threats to deployed assets. The database has also been used to test the validity of Longhurst's CZCS-based worldwide climatology. Copies of all data acquired under this project have also been sent to NAVOCEANO to support their internal database efforts. (Their database is not intended to be available via a public website because many of their data are DoD proprietary.)

IMPACT/APPLICATION

The availability of a single location, uniform-format optics database has already saved the US Navy thousands of dollars in test planning operations and vulnerability assessments. This database has also been used to estimate the performance of a mine hunting system using optical detection techniques. By providing the Navy and the research community with this resource, both types of users will benefit from improved knowledge of the optical properties of the ocean. Access to historical optics data can also be useful for assessing newly acquired data. One can compare the two to see if the new results are atypical, and if so one might go on to determine the cause (e.g. unusual forcing conditions, influx of a different water mass, or perhaps even an instrument calibration problem).

TRANSITIONS

The US Navy is a major participant in the Master Environmental Library (MEL) network of computer systems which is intended to provide a vehicle to find virtually any kind of atmospheric, terrestrial, or oceanographic data. Preliminary discussions have begun to explore the idea of linking the WOOD to the MEL.

RELATED PROJECTS

For the past two years I have managed the Environmental Assessment Project of the SSN Security Program. One task under this project has been to obtain and archive optics-related data from classified sources. These data are being stored in a format that is compatible with the WOOD design so that a classified version of the WOOD could easily be provided to the US Navy. This approach also facilitates the use of common processing and search software. I am also serving as the Environmental Specialist to the Lidar Warning Receiver (LWR) Program for the NSSN. I am using the WOOD to help plan associated Navy field tests and to help build an on-board optics database that will be used to provide the NSSN with vulnerability estimates.

REFERENCES

Longhurst, A., et.al.,"An Estimate of Global Primary Production in the Ocean from Satellite Radiometer Data," J. Plankton Res. 17: 1245-1271, 1995

http://wood.jhuapl.edu